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DUNCAN. Although this theory offers an explanation of the synchronism between light maximum and velocity minimum, yet in the case of RR *Lyræ* it fails to account for the discrepancy that exists between the times of visual and photographic maxima. Consequently, we conclude that before a satisfactory theory can be formulated additional knowledge is required as to the nature of the light variations of the short-period variables as observed in light of different wave-lengths.

April, 1913.

THE VISUAL REGION OF SPECTRUM OF BRIGHTER CLASS A STARS.

BY E. PHŒBE WATERMAN,
Vassar College Fellow in the Lick Observatory, 1912-1913.

Plates of 132 Class A stars were secured with the one-prism spectrographs in regular use with the 36-inch refractor, covering, in two sections, the region K to Hβ. The plates used were Seed 23, stained for the visual region with WALLACE's three-dye solution. The lines present in the visual region of each spectrum were identified by comparison with the spectrum of *α Cygni*, in the Hartmann spectrocomparator, and the wave-length of each line obtained by measuring and reducing (by the Hartmann formula) several spectrograms of this star. Lines which were not found in its spectrum and which appeared in spectra of sub-class A5, were identified from neighboring *α Cygni* lines and the wave-lengths obtained by measurments of A5 spectra with sharp lines.

The results secured were briefly:—

(1) The lines in the visual region agree in general appearance, in source, and in intensity, with those of the photographic region. The contrast with the continuous spectrum is slight, however, and the lines much more difficult to obtain than in the photographic region, so that the criteria afforded by the visual region seem too few to make this part of the spectrum essential in classification work. The *b* group of magnesium shows steady development from sub-class to sub-class, and is of value for classification purposes; the D lines are exceedingly

erratic and not to be depended upon, being present as fine sharp absorption lines in some Class B stars, and appearing only as a faint and hazy blend in some A5 stars.

(2) The lines present in the visual region are the enhanced lines of the metals represented, and include all the stronger lines of the solar chromosphere. Some metals come to an apparent maximum in A2; most metallic lines increase steadily in strength from A0 to A8.

(3) The metals show considerable range in intensity within the limits of each sub-class, a development independent of K. This is one cause of the differences to be found among spectra classified as alike on the basis of K and the hydrogen lines.

(4) A comparison of slit and objective-prism plates (based upon nine stars whose spectra, with the slit spectrograph, showed metal lines unduly strong for the class assigned) shows that the faint lines are finer, more clearly defined, and contrasted more sharply with the continuous spectrum in the slit spectrograms than in the objective-prism plates. Differences between individual lines and between spectra appear in the former which are not striking in the latter. This is a second possible cause of discrepancy among Class A stars.

(5) A count of the stars of the Revised Harvard Photometry by sub-classes shows that for all except Class B, more stars are included in sub-class 0 than in sub-classes 1-4 or 5-6, inclusive, and that in classes A and K respectively the 0 sub-class comprises as many as three and seven times the total number of stars in the rest of the class.

One possible, and easy remedy for the discrepancies among Class A spectra is (1), to adopt Miss CANNON's suggestion as to shifting the sub-classes, making A3 into A5 and A5 into A8, and leaving A0 to A2 for stars now classified as A0; (2) to subdivide these groups on the basis of the metal lines, adopting some system such as is used in libraries for the classification of books, which is capable of indefinite extension and subdivision.

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